

35. CISOL: INTEGRATION, RESEARCH AND EDUCATION IN PHOTOVOLTAICS AS KEY TECHNOLOGY TOWARDS THE SUSTAINABLE ENERGY SYSTEM “BUILDING”

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Key words: *photovoltaic, building integration, integrated energy design, sustainable architecture*

1. Photovoltaic as key technology in sustainable buildings

CISOL is the Solar Research Centre of the Faculty of Architecture ETSAV of the Polytechnic University of Catalonia (UPC). Within its research activities it develops innovative building skins for the architectural integration of solar technologies, with a special focus on photovoltaic.

CISOL has realized in 2005 an innovative PV façade in Barcelona based on colored, semitransparent thin film modules, within the energetic refurbishment of the SCHOTT Ibérica office building. (Figures 1,2,3)

Thermal measurements have been realized and advanced simulation tools have been used to optimize the combination of façade materials, the natural ventilation, sun shading, daylight use, electricity production and the overall architectural quality and energy performance of the building. [1]



Figure 1: Façade exterior

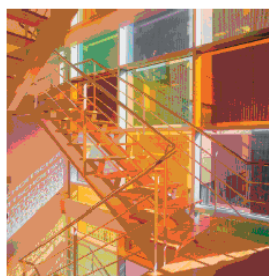


Figure 2: Façade interior

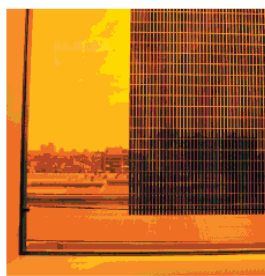


Figure 3: Module detail

For the applied research and innovation in renewable energies in this project CISOL received different prizes like the Environmental Prize of Catalonia 2006 and the EUROSOLAR Solar Prize 2006.

For a second project, a kinder garden in the city of Sant Celoni (Barcelona), a colored, semitransparent PV-panel with polycrystalline silicon cells has been developed for the architectural integration as a south oriented sunscreen in front of the building. The installation will function as a colored filter of the natural sunlight

creating a unique interior atmosphere for the children's rooms and the office areas. First prototypes with colored glass-glass modules have been realized and evaluated. Thermal performance measurements will be evaluated.

A row of design studies shows the variety of possible colored PV module configurations for this project, understanding photovoltaic modules integrated in the building skin as a natural material and design resource for architects.

2. Integrated Energy Design

Integrated Energy Design or *Climate Design* must be the key issue for understanding buildings as potential energy generating systems. The building skin plays a mayor role in this.

Approximately 50 % of all consumed energy world wide is used in the building sector, related to the extraction, transport and transformation of materials, the construction process, the use of buildings through their life span and finally their reutilization, recycling or demolition.

This role of buildings as a main energy consumer has to be inverted. Buildings as net-energy producers are no longer utopia. They already exist as shown with the "Plus Energy Houses" by Rolf Disch in Freiburg, Germany. This buildings proof their efficiency in an annual positive energy balance due to electricity generating solar roofs and a very efficient passive solar architecture.

These kinds of buildings need a careful design process with an energy optimization in every stage. This can only be done by the so-called *integrated energy design* with a close collaboration of architects, engineers and simulation experts. Only this multidisciplinary approach allows the energy optimization of a whole project, the early implementation of the right energy system and the best use of existing resources for bioclimatic architecture like sun, wind and microclimate.

3. Political actions and decisions – obstacles and possibilities

New building legislations in the field of improvement of energy efficiency in buildings, ranging from local solar legislations up to the new national building code are implemented in Spain and most European countries, but far to weak in their requirements.

The building sector, dominated by big companies is not interested in energy efficiency, being low building costs and high profits their main objectives. This will only change when there is a demand for this kind of architecture in the market.

Awareness raising, education and dissemination of environmental and also economic advantages of energy efficient architecture must create this demand.

The introduction of an energy pass for buildings and the direct relation between building standards and energy costs will help in this field and incite society

to demand for low energy architecture. An active tax policy would also be an important instrument to compensate the slightly higher building costs of sustainable buildings.

4. Education

CISOL is focused in his research and educational activities on low energy architecture and renewable energy systems as key factors for a sustainable building culture. Applied research and consultancy on innovative solar technologies for building integration and the optimization of the building skin are main issues of our work (Figure 4). The CISOL - Solar Workshops focus on the integrated energy design as tool towards sustainable architecture. (Figure 5)



Figure 4: CISOL – Research and Consultancy



Figure 5: CISOL-Solar Workshop 2007

This type of planning procedure should be implemented as a general methodology in architectural and urban design to enhance the synergies between renewable energy systems and the complexity of architectural and urban planning parameters like function, form, density, materiality and esthetics. As another educational project a participated PV installation, the “ESTAV Solar garden” will be realized by CISOL at the Campus Sant Cugat.

5. Conclusion

Energy efficiency and renewable energy technologies have to be seen together as the most important parameters in sustainable architecture and urban planning. Integrated solar technologies within multifunctional building envelopes will play a key role in buildings understood as renewable energy systems, which generate more energy than they consume. An outstanding concept in our search for pathways to a sustainable energy future.

References

- [1] T.Masseck, *Monitoring results and overall evaluation of a multifunctional, transparent, colored PV.Façade for the energetic rehabilitation of an office building in Barcelona*, Proceedings of EUROSUN 2006, Glasgow, Great Britain, pag.134-135, The International Solar Energy Society (2006)